



Mark Scheme

Additional SAMS

Pearson BTEC Level 3 National  
Certificate – Applied Human Biology

Unit 1: Principles of Applied Human  
Biology

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# Unit 1: Principles of Applied Human Biology – sample mark scheme

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## General marking guidance

- All learners must receive the same treatment. Examiners must mark the first learner in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Learners must be rewarded for what they have shown they can do rather than be penalised for omissions.
- Examiners should mark according to the mark scheme, not according to their perception of where the grade boundaries may lie.
- All marks on the mark scheme should be used appropriately.
- All marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should be prepared to award zero marks if a learner's response is not worthy of credit, according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a learner's response, the team leader must be consulted.
- Crossed-out work should be marked UNLESS the learner has replaced it with an alternative response.

## Specific marking guidance for levels-based mark schemes

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Levels-based mark schemes (LBMS) have been designed to assess learners' work holistically. They consist of two parts: indicative content and levels-based descriptors. Indicative content reflects specific content-related points that learners might make. Levels-based descriptors articulate the skills that learners are likely to demonstrate in relation to the skills being assessed in the question. The levels represent the progression of these skills.

When using a levels-based mark scheme, the 'best fit' approach should be used.

- Examiners should first make a holistic judgement on which band most closely matches learners' response and place it within that band. Learners will be placed in the band that best describes their answer.
- The mark awarded within the band will be decided based on the quality of the answer in response to the level descriptor, and will be modified according to how securely all traits are displayed at that band.

Question number	Answer	Additional guidance	Mark
1 (a)	D - Protein		(1)
1 (b)	<p>Award <b>1</b> mark for identification and <b>1</b> mark for linked expansion. Up to a maximum of <b>4</b> marks.</p> <ul style="list-style-type: none"> <li>• large surface area/presence of microvilli (1)</li> <li>• increased uptake of nutrients (1)</li> <li>• thin walls (1)</li> <li>• shorter distance for molecules to travel into the blood (1)</li> <li>• lacteals/lymph capillaries (1)</li> <li>• take up (fat droplets formed from) absorbed lipid (1)</li> </ul> <p>Accept any other reasonable response.</p>		(4)
1 (c)	absorption/ diffusion/ active transport	Do not accept osmosis	(1)
Total			6 marks

Question number	Answer	Additional guidance	Mark
2 (a)	<p>Award <b>1</b> mark for identification and <b>1</b> mark for linked expansion. Up to a maximum of <b>4</b> marks.</p> <p>Swelling</p> <ul style="list-style-type: none"> <li>• increased {movement/accumulation} of tissue fluid into the area (1)</li> <li>• increased movement of white blood cells into the area/plasma is able to move into tissue fluid (1)</li> </ul> <p>Bruising</p> <ul style="list-style-type: none"> <li>• {blood vessels/capillaries} are {damaged/ruptured} (1)</li> <li>• blood collects beneath the skin (1)</li> </ul>	Accept any correct explanation making reference to the inflammatory response	(4)
2 (b)	A - Plasma		(1)
2 (c)	To create a barrier/prevent infection		(1)
Total			6 marks

Question number	Answer	Mark
3 (a)	B - Glycogen	(1)
3 (b)	loss of sensation/ tingling in extremities/ loss of function of the feet/muscle weakness  Accept any other reasonable response.	(1)
3 (c)	Answers will be credited according to the learner's demonstration of knowledge and understanding of the material, using the indicative content and levels descriptors below. The indicative content that follows is not prescriptive. Answers may cover some or all of the indicative content but learners should be rewarded for other relevant answers.  <ul style="list-style-type: none"> <li>• after eating, blood glucose is higher</li> <li>• person measures blood sugar levels</li> <li>• inject insulin</li> <li>• insulin in the blood stimulates the uptake of glucose</li> <li>• use of glucose in respiration is increased</li> <li>• liver cells convert glucose to glycogen</li> <li>• glycogen is stored</li> <li>• blood glucose levels fall</li> </ul>	(6)

<b>Mark scheme (award up to 6 marks).</b> Refer to the guidance on the cover of this document for how to apply levels-based mark schemes*.		
Level	Mark	Descriptor
Level 0	0	No rewardable material.
Level 1	1–2	<ul style="list-style-type: none"> <li>• Demonstrates isolated knowledge and understanding, there be major gaps or omissions</li> <li>• Generic statements may be presented rather than linkages being made so that lines of reasoning are not present</li> <li>• Limited explanation which is not logically ordered and with significant gaps.</li> </ul>
Level 2	3–4	<ul style="list-style-type: none"> <li>• Demonstrates mostly accurate knowledge and understanding, with few minor omissions/any gaps or omissions are minor</li> <li>• Some linkages are made so that lines of reasoning are partially present</li> <li>• Displays a partially developed explanation that has a structure which is mostly clear, coherent and logical with only minor omissions.</li> </ul>
Level 3	5–6	<ul style="list-style-type: none"> <li>• Demonstrates accurate and thorough/detailed knowledge and understanding</li> <li>• Linkages are consistently made so that lines of reasoning are sustained</li> <li>• Displays a well-developed explanation that has a structure which is clear, coherent and logical.</li> </ul>

Question number	Answer	Mark
3 (d)	Any <b>two</b> from the following: <ul style="list-style-type: none"> <li>lose weight/consume fewer calories (1)</li> <li>increase her level of exercise (1)</li> <li>eat a balanced diet (1)</li> </ul>	(2)
Total		10 marks

Question number	Answer	Additional guidance	Mark
4 (a)(i)	<ul style="list-style-type: none"> <li>cyclic pressure increase and decrease (1)</li> <li>pressure rises over 0.10 s up to a maximum of 100 mmHg (1)</li> <li>pressure drops over 0.90 s to a minimum of 55 mmHg (1)</li> </ul>		(3)
4 (a)(ii)	Substitution (1) 60 /length of one beat  Evaluation (1) 60 beats per minute	Accept answers from 59-61	(2)
4 (b)(i)	One from the following: <ul style="list-style-type: none"> <li>provides a picture of how blood pressure changes throughout the day</li> <li>doctor's office may be stressful and produce an exaggerated result</li> <li>multiple readings allow for an average to be calculated</li> </ul> Accept any other reasonable answer.		(1)
4 (b)(ii)	B - 120/80 mmHg		(1)
4 (c)	Award <b>1</b> mark for identification and <b>2</b> marks for linked expansion up to a maximum of <b>3</b> marks.  <b>Identification</b>  {constant pressure/friction} on the skin (1)  <b>Linked expansion</b>  stops blood flowing (1)  so the skin cells die and the skin breaks down (1)  (low) blood pressure may be insufficient to move blood through compressed vessels (1)		(3)
Total			10 marks

Question number	Answer	Additional guidance	Mark									
5 (a)	<p>Award <b>1</b> mark for identification and <b>2</b> marks for linked expansion. Up to a maximum of <b>3</b> marks.</p> <p><b>Identification</b></p> <p>fertilized {egg/embryo} has an extra copy of chromosome 21 (1)</p> <p><b>Linked expansion</b></p> <p>because of an error in meiosis (1)</p> <p>so one of the gametes gets two copies of chromosome 21 (1)</p>		(3)									
5 (b)(i)	<p>Award <b>1</b> mark for identification and <b>2</b> marks for linked expansion. Up to a maximum of <b>3</b> marks</p> <p><b>Identification</b></p> <p>(Figure 3) shows unaffected parents with affected offspring (1)</p> <p><b>Linked expansion</b></p> <p>it is possible to have a copy of the allele but not be affected (1)</p> <p>parents act as carriers (1)</p>	Accept Dominant disorder would be present in every generation	(3)									
5 (b)(ii)	<p>Cheek swab/blood sample/hair sample</p> <p>Accept any other reasonable response.</p>		(1)									
5 (c)(i)	<table border="1" data-bbox="360 1361 1046 1653"> <tbody> <tr> <td></td> <td><math>X^H</math></td> <td><math>X^h</math></td> </tr> <tr> <td><math>X^H</math></td> <td><math>X^HX^H</math></td> <td><math>X^HX^h</math></td> </tr> <tr> <td>Y</td> <td><math>X^HY</math></td> <td><math>X^hY</math></td> </tr> </tbody> </table>		$X^H$	$X^h$	$X^H$	$X^HX^H$	$X^HX^h$	Y	$X^HY$	$X^hY$		(1)
	$X^H$	$X^h$										
$X^H$	$X^HX^H$	$X^HX^h$										
Y	$X^HY$	$X^hY$										
5 (c)(ii)	1:3	Allow ecf for incorrectly completed Punnet square in 5 (c) (i)	(1)									

5 (c)(iii)	<p>Award <b>1</b> mark for identification and <b>1</b> mark for linked expansion. Up to a maximum of <b>2</b> marks.</p> <p><b>Identification</b></p> <p>The haemophilia allele is only on the X chromosome/not on the Y chromosome (1)</p> <p><b>Linked expansion</b></p> <p>Boys can only inherit the Y chromosome from their father (1)</p>		(2)
Total			11 marks

Question number	Answer	Mark
6 (a)(i)	<p>Any <b>two</b> from the following:</p> <p>if a patient is too {hot/cold} it may affect their body's function (1)</p> <p>optimum body temperature is 37°C (1)</p> <p>a high temperature may be a sign of infection (1)</p> <p>(temperature) is used to assess general health/detect problems in the body (1)</p>	(2)
6 (a)(ii)	C - Hypothalamus	(1)
6 (b)	<p>Answers will be credited according to the learner's demonstration of knowledge and understanding of the material, using the indicative content and levels descriptors below. The indicative content that follows is not prescriptive. Answers may cover some or all of the indicative content but learners should be rewarded for other relevant answers.</p> <ul style="list-style-type: none"> <li>• Thermoreceptors in the skin</li> <li>• Temperature changes detected by the hypothalamus</li> </ul> <p>Fall in temperature</p> <ul style="list-style-type: none"> <li>• Vasoconstriction initiated by the hypothalamus</li> <li>• Blood directed to the core of the body</li> <li>• Contraction of arrector-pilli muscles</li> <li>• Sweat reduction to decrease energy loss from the skin</li> <li>• Shivering/rapid contraction of muscles</li> <li>• Increased metabolic rate</li> <li>• Secretion of TSH by pituitary gland</li> <li>• Thyroxine released increases metabolic rate in cells</li> </ul>	(9)



	<p>Rise in temperature</p> <ul style="list-style-type: none"> <li>• Vasodilation</li> <li>• Dilation of blood vessels near the surface of the skin</li> <li>• More heat released by radiation</li> <li>• Relaxation of arrector-pilli muscles</li> <li>• Sweat increase</li> <li>• More heat energy lost from the skin due to the process of evaporation</li> </ul>	
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**Mark scheme (award up to 9 marks).** Refer to the guidance on the cover of this document for how to apply levels-based mark schemes\*.

Level	Mark	Descriptor
Level 0	0	No rewardable material.
Level 1	1-3	<ul style="list-style-type: none"> <li>• Demonstrates isolated elements of knowledge and understanding, there will be major gaps or omissions.</li> <li>• Few of the points made will be relevant to the context in the question.</li> <li>• Limited evaluation that contains generic assertions, leading to a conclusion that is superficial or unsupported.</li> </ul>
Level 2	4-6	<ul style="list-style-type: none"> <li>• Demonstrates some accurate knowledge and understanding, with only minor gaps or omissions.</li> <li>• Some of the points made will be relevant to the context in the question, but the link will not always be clear.</li> <li>• Displays a partially developed evaluation that considers some different competing points, although not always in detail, leading to a conclusion that is partially supported.</li> </ul>
Level 3	7-9	<ul style="list-style-type: none"> <li>• Demonstrates mostly accurate and thorough/detailed knowledge and understanding.</li> <li>• Most of the points made will be relevant to the context in the question, and there will be clear links.</li> <li>• Displays a developed and logical evaluation that clearly considers different aspects and competing points in detail, leading to a conclusion that is fully supported.</li> </ul>

Question number	Answer	Additional Guidance	Mark
7 (a)	<p><b>W</b> ATP/ adenosine triphosphate</p> <p><b>X</b> ADP/ adenosine diphosphate</p> <p><b>Y</b> Fructose biphosphate/hexose diphosphate</p> <p><b>Z</b> Pyruvate</p>	Allow correctly named 3C molecule for <b>Y</b> provided candidate has indicated <b>2</b> would be produced	(4)
7 (b)(i)	<p>Award <b>1</b> mark for identification and <b>1</b> for linked expansion, for a maximum of <b>3</b> marks.</p> <p>Reduced respiration in cells of the heart (1)</p> <p>So causes the cells in the heart to die (1)</p> <p>Heart muscle cannot contract/ heart cannot pump blood around the body effectively (1)</p> <p>reducing the amount of oxygen reaching the body's cells (1)</p> <p>less energy released/ATP produced (1)</p> <p>Accept any other reasonable response.</p>		(3)
7 (b)(ii)	B- Anoxia		(1)
7 (c)	<p>Award <b>1</b> mark for each identification and <b>1</b> for each linked expansion, for a maximum of <b>4</b> marks.</p> <p><b>Identification</b></p> <p>Use nerve conduction velocity test (1)</p> <p><b>Linked expansion</b></p> <p>Measures speed of impulse transmission (1)</p> <p>(because) Abnormal nerve impulse speeds may be a sign of nerve damage (1)</p> <p><b>Identification</b></p> <p>Use reflex testing (1)</p> <p><b>Linked expansion</b></p> <p>Check for involuntary movement in response to a stimulus (1)</p> <p>(because) Lack of involuntary movement may be a sign of nerve damage (1)</p>		(4)
Total			12 marks

Question number	Answer	Mark
8 (a)	D - Neutrophil	(1)
8 (b)	<p>Any <b>3</b> of the following given in a logical order:</p> <p>Pathogen binds to receptors on the surface of the white blood cell (1)</p> <p>The white blood cell engulfs the pathogen (1)</p> <p>Pathogen encased in a membrane inside cell (1)</p> <p>Lysosomes break down the pathogen (1)</p> <p>Digested products are absorbed (1)</p> <p>Accept any other reasonable response.</p>	(3)
8 (c)	<p>Answers will be credited according to the learner's demonstration of knowledge and understanding of the material, using the indicative content and levels descriptors below. The indicative content that follows is not prescriptive. Answers may cover some or all of the indicative content but learners should be rewarded for other relevant answers.</p> <p><b>Passive immunity</b></p> <ul style="list-style-type: none"> <li>• mother produces antibodies after a vaccine</li> <li>• antibodies pass to the fetus through the placenta</li> <li>• antibodies will pass to the baby through breast milk</li> <li>• baby is not able to make its own antibodies to the disease until its immune system develops more</li> <li>• over time the antibodies break down</li> <li>• once the mother's antibodies are gone the baby will be susceptible to whooping cough</li> <li>• immunity is fast acting</li> <li>• passive immunity is temporary</li> </ul> <p><b>Artificial immunity</b></p> <ul style="list-style-type: none"> <li>• inactive pathogen introduced to the body</li> <li>• baby does not suffer from the symptoms of the disease</li> <li>• the immune system recognises the antigens of the pathogen</li> <li>• baby makes antibodies to the disease</li> <li>• memory cells are produced</li> <li>• if the child comes into contact with the pathogen again they are able to rapidly divide and differentiate into plasma cells and produce antibodies</li> <li>• there is a delay between immunisation and immunity</li> <li>• artificial immunity lasts longer than passive immunity</li> </ul>	(9)

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<b>Level</b>	<b>Mark</b>	<b>Descriptor</b>
Level 0	0	No rewardable material.
Level 1	1–3	<ul style="list-style-type: none"> <li>• Demonstrates isolated elements of knowledge and understanding, there will be major gaps or omissions.</li> <li>• Few of the points made will be relevant to the context in the question.</li> <li>• Limited discussion that contains generic assertions rather than considering different aspects and the relationship between them.</li> </ul>
Level 2	4–6	<ul style="list-style-type: none"> <li>• Demonstrates some accurate knowledge and understanding, with only minor gaps or omissions.</li> <li>• Some of the points made will be relevant to the context in the question, but the link will not always be clear.</li> <li>• Displays a partially developed discussion that considers some different aspects and some consideration of how they interrelate, but not always in a sustained way.</li> </ul>
Level 3	7–9	<ul style="list-style-type: none"> <li>• Demonstrates mostly accurate and detailed knowledge and understanding.</li> <li>• Most of the points made will be relevant to the context in the question, and there will be clear links.</li> <li>• Displays a well-developed and logical discussion that clearly considers a range of different aspects and how they interrelate, in a sustained way.</li> </ul>